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FOREST SERVICE

FOREST PEST MANAGEMENT

STATE & PRIVATE FORESTRY

INTERMOUNTAIN REGION

WESTERN SPRUCE BUDWORM ACTIVITY DURING 1983 AND PREDICTED ACTIVITY FOR 1984 ON THE BOISE AND PAYETTE NATIONAL FORESTS AND ADJACENT FOREST LANDS

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By

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ABSTRACT

Susceptible conifers on approximately 1.28 million acres of forest land were visibly defoliated by western spruce budworm (WSBW) during 1983. Egg mass evaluations used to forecast WSBW activity in 1984 were conducted on 348 sample points. In 1984, spruce budworm activity in older infestation areas on the Payette and Boise National Forests should decline, while in the remaining areas activity should be static or increasing. Specific locations of 1983 activity and that forecast for 1984 are discussed.

INTRODUCTION

Defoliation of conifers by western spruce budworm (WSBW), Choristoneura occidentalis Freeman, has been observed on the Boise and Payette National Forests since 1954, (Table 1). It has resulted in varying degrees of top-kill and occasional understory mortality. Land managers are deeply concerned about this insect: where it is currently active and where it will be active next year. Aerial detection surveys covering the Boise and Payette National Forests and adjacent forest lands were conducted by Forest Pest Management to identify intensity and extent of the current infestation. Population sampling to project WSBW activity in 1984 was conducted jointly by the State of Idaho and Forest Pest Management personnel.

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EXPERIMENT STATION

Table 1
EXTENT OF DEFOLIATION BY WESTERN SPRUCE BUDWORM ON AND ADJACENT TO THE BOISE AND PAYETTE NATIONAL FORESTS 1954-1983. 1/

Year	Extent of Defoliation (acres)		
	Boise NF	Payette NF	Total
1954	514,000	114,000	628,000
1955	681,000	358,000	1,039,000
1956	308,970	383,310	692,280
1957	131,370	445,580	576,950
1958	33,700	14,850	48,550
1959	0	5,000	5,000
1960	0	0	0
1961	35,500	34,500	70,000
1962	60,000	137,000	197,000
1963	56,160	173,920	230,080
1964	46,080	147,460	193,540
1965	60,200	216,800	277,000
1966	59,400	83,700	143,100
1967	28,900	79,600	108,500
1968	27,700	221,600	249,300
1969	31,000	362,200	393,200
1970	5,800	220,900	226,700
1971	17,200	316,200	333,400
1972	4,200	400,100	404,300
1973	3,700	203,400	207,100
1974	121,600	208,800	330,400
1975	132,500	414,000	546,500
1976	90,300	422,400	512,700
1977	132,100	354,000	486,100
1978	228,000	308,900	536,900
1979	258,000	303,900	561,900
1980	204,200	207,600	411,800
1981	303,300	300,500	603,800
1982	674,400	365,400	1,039,800
1983	811,012	469,022	1,280,034

1/ Does not include defoliated acreage within the River of No Return Wilderness (Idaho Primitive Area) after 1978

METHODS

Aerial Detection Survey - Aerial detection surveys to detect WSBW and other insect activity were conducted on a drainage by drainage basis from low flying fixed wing aircraft during July and August. Most forested lands in or adjacent to the Boise and Payette National Forest except lands within the River of No Return Wilderness, Seven Devils Wilderness and Sawtooth Wilderness were surveyed. Location and intensity of defoliation were mapped.

Defoliation intensity was classified into three levels: light, moderate, and heavy. Determination of defoliation intensity was based on the percent of aerially visible defoliation observed in the crowns of susceptible conifers: areas where individual tree crowns were less than 30%, 30-70%, and over 70% defoliated were classified as light, moderate and heavy respectively.

Population Sampling - A sequential classification system was used to sample WSBW egg masses (Scrivastava and Campbell, in preparation). Such a system requires the use of a sequential table. For these evaluations the sequential table (Appendix I) was developed with a variable WSBW density dependent, value of the negative binomial parameter k. The sequential classification system was divided into three predictive defoliation levels: light, moderate and heavy.

To facilitate population sampling and defoliation forecasting the infestation was divided into 11 entomological units (EU) as identified previously (Williams et al. 1981.) An additional EU (No. 12) was delineated to encompass areas of defoliation detected since 1981. As suggested by representatives from Boise and Payette National Forests, State of Idaho and Boise Cascade Corporation only populations in EU Nos. 1, 2, 4, 5, 8, 11 and 12 were sampled.

Sample-point location was based primarily upon presence of host type and accessibility. Previously established WSBW impact and egg-mass sampling points were used wherever possible. Entomological unit and sample point locations are shown in Fig. 1.

At each sample point, 10 true fir (Abies spp.) were randomly selected, and one 45-centimeter-long branch was cut from approximately mid-crown of each tree. If true fir was unavailable, Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) was sampled. Foliage from each sample point was retained separately in cloth bags and placed in cold storage until processed by a laboratory crew. Generally, foliage was stored for not more than six days.

In the laboratory, numbers of viable and non-viable WSBW egg masses on each branch were counted. The sequential table Appendix was used to determine the number of egg masses and trees from each sample point needed to make a 1984 defoliation prediction.

RESULTS AND DISCUSSION

Of nearly three million acres surveyed, approximately 1,280,000 acres of forest land within and adjacent to the Boise and Payette National Forests were visibly defoliated by WSBW in 1983 (Fig. 1), an increase of 240,000 acres from 1982 (Table 2).

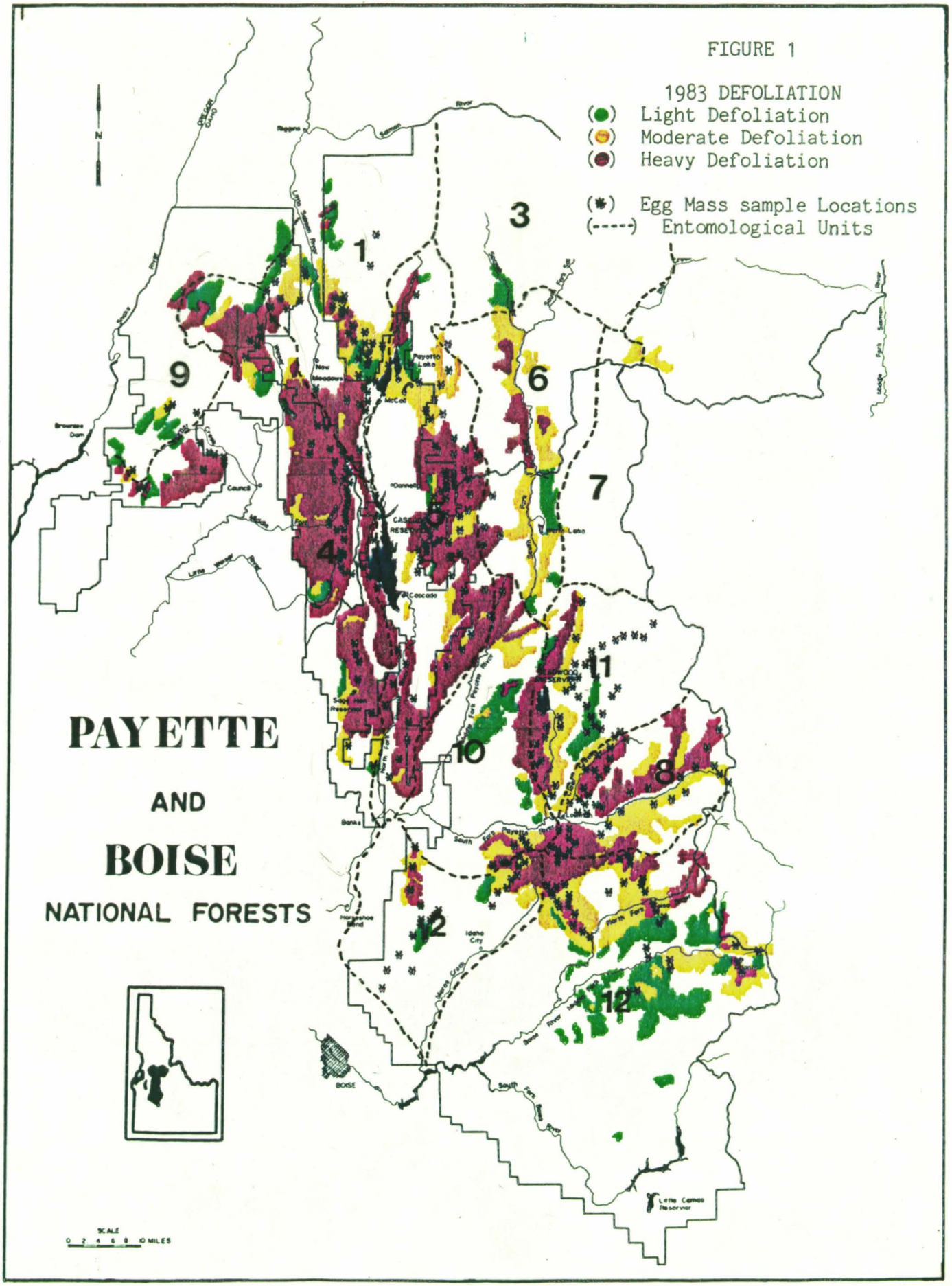
FIGURE 1
1983 DEFOLIATION
Light Defoliation
Moderate Defoliation
Heavy Defoliation
Egg Mass sample Locations
Entomological Units
PAYETTE
AND
BOISE
NATIONAL FORESTS
1
2
3
4
5
6
7
8
9
10
11
12
SCALE
0 2 4 6 8 10 MILES

Table 2
INTENSITY OF VISIBLE DEFOLIATION BY WESTERN SPRUCE BUDWORM ON AND ADJACENT TO BOISE AND PAYETTE NATIONAL FORESTS DURING 1982 AND 1983 AS DETERMINED FROM AERIAL DETECTION SURVEYS

Forest (and adjacent land)	Year	Defoliation Intensity (acres) Light (acres)	Moderate (acres)	Heavy (acres)	Total (acres)	Trend (acres)
Boise	1982	140,902	361,643	171,936	674,481	
	1983	140,277	290,313	380,421	811,011	+136,530
Payette	1982	68,640	158,586	138,154	365,380	
	1983	69,684	132,875	266,444	469,003	+103,623
Total	1983	209,961	423,188	646,865	1,280,014	+240,153

Defoliation of susceptible conifers was detected on approximately 811,000 acres on the Boise National Forest and adjacent lands. In 1982 defoliation was detected on approximately 675,000 acres. Most of this increase was due to expansions of existing infestations into contiguous areas rather than the development of new isolated infestations. New infested areas occurred primarily in the Douglas-fir and subalpine fir habitat types located on the Idaho City and Boise Ranger Districts. Compared to 1982, area of heavy defoliation doubled in 1983 with most of the change occurring on the Boise and Idaho City Ranger Districts, and within areas treated with Orthene and Sevin during the 1979 control project.

Area of WSBW defoliation on the Payette National Forest and adjacent areas increased from 370,000 acres in 1982 to approximately 470,000 acres in 1983. Most of the expansion occurred in Douglas-fir and subalpine fir habitat types in the Cuddy Mountain area west of Council, Idaho. Area of heavy defoliation doubled in size, encompassing approximately 266,000 acres of primarily Douglas-fir and true fir. Increases in defoliation intensity were most evident along the Weiser River drainage in the West Mountains and throughout the Cuddy Mountain area. Reductions in defoliation intensity were observed along the Little Salmon River drainage and in the Brundage Mountain area.

A detailed report of aerial detection survey information accompanied by defoliation forecasts for 1984 in each EU follows. Total number of plots sampled, and predicted 1984 defoliation levels for each EU sampled are displayed in Table 3.

Table 3
PREDICTED DEFOLIATION BY WESTERN BUDWORM ON THE BOISE AND PAYETTE NATIONAL FORESTS AS DETERMINED BY THE 1983 EGG MASS SURVEY

PREDICTED 1984 DEFOLITION

Entomological unit	Total # of points sampled	Light	Moderate	Heavy
1. Little Salmon River	41	20	17	4
2. Mores & Grimes Creek	38	11	12	15
4. Weiser River	57	29	14	14
5. North Fork Payette River	92	15	40	37
8. South Fork Payette River	40	6	16	18
11. Deadwood River	40	15	19	6
12. North and Middle Fork Boise River	40	11	19	10
TOTAL	348	107	137	104

Entomological Unit 1 - Little Salmon River Drainage - Defoliation in the Boulder Creek area, north of New Meadows, was light with some areas of host type exhibiting no aerially visible defoliation, however occasional heavily defoliated spots were observed. Defoliation in other areas of the unit remained static.

Egg mass population data indicate that hosts in the northern portion of the unit will continue to experience light to moderate defoliation with a few scattered areas of heavy defoliation. Reductions in defoliation intensity are forecast for the previously heavily defoliated areas in the southern portion of the unit.

Entomological Unit 2 - Mores Creek Drainage - Moderate to heavy defoliation in the Hawley Mountain area has been mapped for the last eight consecutive years. Egg mass population samples project moderate to heavy defoliation to continue throughout the area in 1984.

Defoliation in other areas of the EU was first observed in 1981. Most of this defoliation is concentrated in Douglas-fir habitat types located in the upper Grimes Creek-Mores Creek area and has continued to increase in extent and intensity. Defoliation intensity is expected to increase in the light and moderate areas and remain static or decrease in heavy areas.

Defoliation was not observed during aerial surveys in the Boise Ridge area, however subsequent ground evaluations revealed that very light defoliation was

present. Egg mass samples indicate that defoliation extent and intensity may increase in this area.

Entomological Unit 3 - Lower South Fork of the Salmon - Secesh River Drainages
During 1983 defoliation was not observed nor was egg mass sampling conducted in EU 3.

Entomological Unit 4 - Weiser River and Squaw Creek Drainage - Susceptible hosts throughout much of their range in EU 4 continued to be heavily defoliated. The west side of the West Mountains was the heaviest defoliated area in the EU. Widespread reductions in defoliation intensity occurred throughout substantial portions of the Middle Fork of the Weiser River and Squaw Creek drainages, with only occasional "hot spots" in 1984.

As predicted by the 1982 egg mass survey (Cahill & Knapp, 1983), the relatively new infestation located in the Cuddy Mountain area increased in size and intensity. Since most of the host type in this area is currently infested, infestation size should not increase greatly next year. Results from sampling indicate less defoliation in 1984.

Entomological Unit 5 - North Fork of the Payette River - The West Mountain area remains the most heavily defoliated area on the Boise and Payette National Forests. The large number of egg masses encountered indicate that heavy defoliation will persist throughout this portion of the unit next year.

Areas of host type northeast of McCall sustained mostly light to moderate defoliation, while areas south of McCall along the North Fork of the Payette River sustained heavy defoliation. Generally light to moderate (with occasional heavy) levels of defoliation should be prevalent for this portion of the unit during 1984.

As projected by high egg mass counts last year, the 1979 treatment area (Livingston, et al. 1982) showed susbstantial increases in defoliation intensity. Egg mass counts this year forecast continued moderate to heavy defoliation in the treatment area.

Entomological Unit 6 - South Fork of the Salmon River - Defoliation detected in this unit was of mostly moderate to heavy intensity. Egg mass sampling was not conducted in unit 6.

Entomological Unit 7 - Landmark - Johnson Creek - Total area of defoliation decreased from 1982 with the only detected defoliation occurring along the Salmon River south of Missouri Ridge. Egg mass sampling was not conducted in unit 7.

Entomological Unit 8 - South Fork of the Payette River Drainage - Defoliation in this unit was first detected in 1980. Presently most of the host type in the South Fork of the Payette River drainage is moderately or heavily defoliated, with the most severe defoliation occurring along Canyon Creek north of Grandjean. Moderate defoliation was present along the south side of the South Fork of the Payette River. Egg mass data indicate that defoliation in 1984 should be similar to that observed in 1983.

Entomological Unit 9 - Bear Creek Area - Defoliation increased in extent and

intensity over that observed in 1982. Most defoliation continued to be concentrated along Bear Creek, Lick Creek and Indian Creek. Egg mass sampling was not conducted in unit 9.

Unit 10 - Middle Fork of the Payette River - Defoliation intensity and extent increased throughout this unit during 1983. Most new defoliation was detected along the east side of the North Fork Range and throughout Rattlesnake and Bulldog Creeks. Most host type is currently infested. Egg mass sampling was not conducted in unit 10.

Entomological Unit 11 - Deadwood River Drainage - Defoliation in this unit was initially observed in 1981. Since then, spread of WSBW has continued, primarily in Douglas-fir habitat types. Most defoliation was categorized as being heavy on the west side of Deadwood River and light or moderate east of Deadwood River. Defoliation extent and intensity are expected to increase east of Deadwood River. Static or decreasing defoliation is expected west of Deadwood River.

Entomological Unit 12 - Middle Fork and North Fork of the Boise River - Considerable expansion in defoliation extent and increases in defoliation intensity were detected throughout the unit. Greatest defoliation expansion occurred south of the Middle Fork of the Boise River primarily in Douglas-fir. Heaviest defoliation occurred near Beaver Creek on the Idaho City Ranger District, visible from Highway 21. Continued WSBW expansion into previously undefoliated Douglas-fir stands should occur with increases in defoliation severity experienced throughout the unit.

SUMMARY

Western spruce budworm currently infests approximately 1.3 million acres on and around the Boise and Payette National Forests. Some areas have been defoliated continuously for over ten years. Results of the 1983 egg mass survey indicate that these older infestations, primarily stands stocked largely with grand fir in EUs 1 and 4, will experience a reduction in defoliation intensity during 1984. Specific areas which should show substantial reductions in defoliation intensity are: the Goose Creek area north of McCall; the Lost Creek area west of New Meadows: Middle Fork of the Weiser River drainage, east of Council; and the Rammage Meadows area north of Sage Hen Reservoir.

Defoliation in units 5 and 8 should remain static, while in units 11, 12 and 2 it should intensify and expand into previously undefoliated Douglas-fir stands.

MANAGEMENT ALTERNATIVES

Maintain Present Management - The infestation will be allowed to continue, likely for 7-10 years, until natural abatement occurs. Short-term resource impacts including growth loss, top-kill, some understory mortality, and reduced

seed production will be accepted. Generally, impacts should be less in mixed species stands.

Direct Suppression - One or more available registered insecticides, carbaryl, acephate, malathion, or Bacillus thuringiensis Berliner, a microbial insecticide will be applied either to the entire infestation or to a portion thereof. Approximate costs would be $10 to $15 per acre. Short-term impacts to the various resources would be reduced significantly for a three to four year period, after which the populaton likely would return to prespray levels. Because treatment would preserve the food base, a chronic infestation could develop, particularly if suppression is undertaken whenever the population resurges to damaging levels.

Silvicultural Management - Stands susceptible to WSBW activity will be managed to reduce potential for damage. Such treatments include: (1) striving for species diversity favoring seral species, (2) maintaining or improving vigor of a stand by conducting timely thinnings and selecting against trees affected with other damage agents including dwarf mistletoe and root/stem decays, (3) harvesting susceptible stands at maturity using even-age regeneration systems. This long-term approach is aimed at reducing the impact of future outbreaks. During the current infestation, such management will be of benefit to only those stands treated.

RECOMMENDATIONS

An integreated approach is recommended to deal with current and future WSBW infestations. Since sound silviculture is also good pest management, silvicultural management is recommended as a base program. Stands with highest value and potential impact should be treated first.

Direct suppression may be considered in high-value young stands, recreation, and seed producton areas. This type of protection would be a short-term solution due to insect populations resurging from contiguous areas.

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APPENDIX

SEQUENTIAL SAMPLING SCHEME FOR WSBW EGG-MASS POPULATIONS ON MIDCROWN 45-cm BRANCH TIPS 1/

Number of Trees	Number of Egg Masses 2/			
	Light	Moderate	Moderate	Heavy
10	3	5	9	10
14	4	6	13	15
15	5	7	14	16
20	6	10	19	21
25	8	12	24	26
50	16	24	48	52
60	19	29	58	63
70	23	34	67	74
80	26	39	77	84
90	29	43	87	95
100	32	48	97	105

1/ Scrivastava and Campbell (in preparation)
2/ 95% confidence level